

REVERSIBLE MAGNETIC DOOR STOP/LATCH

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BACKGROUND OF THE INVENTION

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application is a divisional of U.S. Appl. No. 10/308,109 filed December 3, 2002 that issued as U.S. Patent No. 6,588,811 on July 8, 2003, the entire disclosure of which is hereby incorporated by reference.

Field of the Invention

[0002] This invention relates to magnetic door stops and latches. More particularly, this invention relates to a device that uses the attractive and repulsive characteristics of magnets for purposes of (1) preventing doors and other similar closures from slamming against a wall, baseboard, door jamb or door frame, or minimizing the force of such slamming, and (2) holding doors or similar closures in a stationary open or closed position, such that the door can be moved from such stationary position by applying sufficient force to overcome the magnetic force.

Background of the Invention

[0003] Magnets have been used in devices for holding doors in the closed position. For example, magnetic door latch devices have been previously developed and are commonly found in the doors of kitchen cabinets, refrigerators, freezers, media cabinets, storage containers and numerous other such closures. Magnets have also been used in connection with mechanical latches and locks, with magnetic (usually electromagnetic) force applied to move or actuate a mechanical latch or lock mechanism.

[0004] Other magnetic devices have been previously developed for holding doors open. For example, simple magnetic door catches, such as that disclosed in United States Patent No. 4,505,502, are also well known. Such devices use permanent magnetic force to hold a door in the open position, but perform no other function. Magnetic door holding devices also have been previously used in connection with fire safety systems, in which fire doors are held open by magnetic contacts on both the door and a wall behind the door. In such devices, the magnetic force holding the door open is overcome by electromagnetic or other means, thus automatically allowing the fire doors to swing closed.

[0005] While the use of magnets in these applications is well known, magnetic forces are not addressed to the problem of stopping doors from slamming or banging when opened or closed violently. Therefore, there arises a need in the art for a magnetic door stop that uses the repulsive forces of the magnets to prevent a door from slamming into a wall or door frame. More specifically, there arises a need in the art for a magnetic door stop that uses both the repulsive and attractive forces of magnets, selectively at the option of the user, to either hold a door in the open position (using the attractive forces of the magnets) or prevent a door from slamming (using the repulsive forces of the magnets).

SUMMARY OF THE INVENTION

[0006] To achieve the foregoing and other objects, and in accordance with the purposes of the present invention as embodied and broadly described herein, the present invention provides a magnetic apparatus that functions to prevent slamming of a door or other such closure using the repulsive forces of a magnet. The present invention also provides such a device that can be selectively set by the user so that in one position the device secures a door or other such closure device in an opened or closed position (using the attractive forces of the magnets) and in another position the device acts to prevent a door from slamming (using the repulsive forces of the magnets).

[0007] In accordance with one aspect of the present invention, one magnet is mounted on or within a door and one magnet is mounted on a structure opposing the door, such as a baseboard, wall, or doorframe. The like poles of the magnets are adjacent to one another and thus repel one another. This may be accomplished in many possible configurations, including with the magnets aligned so that they make contact with one another upon the exertion of sufficient force, or with the magnets not actually making contact with one another but rather reaching sufficient proximity for the repulsive force to act in controlling or arresting the motion of the door.

[0008] In further accordance with the present invention, one of the two magnets may be mounted in a fashion that allows the magnet to be rotated or otherwise repositioned, such that in a one position, opposite magnetic poles of two magnets are adjacent to each other, and in a second position, like magnetic poles of the magnets are adjacent to each other.

[0009] The present invention has the advantages of providing an inexpensive, simple, and easy to operate mechanism that prevents noise and damage from slamming doors, but yet can be easily overridden by application of a moderate amount of manual force. The present invention also provides a simple means of selectively holding a door open or closed, but in a manner that allows the door to be manually moved. All of these advantages are achieved without moving parts, or with a minimal number of moving parts, this reducing the difficulties associated with installation, maintenance and use.

BRIEF DESCRIPTION OF THE FIGURES

[0010] The foregoing and other features and advantages of the invention will be apparent from the following, more particular description of a preferred embodiment of the invention, as illustrated in the accompanying drawings.

[0011] FIG. 1 shows the magnetic door stop in the repulsive configuration to prevent a door from slamming into an opposing wall and baseboard.

- [0012] FIG. 2 shows the magnetic door stop in the attractive configuration to hold the door in an open position.
- [0013] FIG. 3 is a side view of the magnetic door stop mounted within a door.
- [0014] FIG. 4 is a side view of the magnetic door stop mounted onto a door.
- [0015] FIG. 5 is a side view of the magnetic door stop mounted within a baseboard.
- [0016] FIG. 6 is a side view of the magnetic door stop mounted onto a baseboard.
- [0017] FIG. 7 shows a magnet holding device to allow a user to selectively choose between the repulsive configuration or the attractive configuration.
- [0018] FIG. 8 is an alternate embodiment of the magnet holding device shown in FIG. 7.
- [0019] FIG. 9 is an alternate embodiment of the magnet holding device to allow a user to selectively choose between the repulsive configuration or the attractive configuration.
- [0020] FIG. 10 is a side view of the magnet holding device shown in FIG. 9.
- [0021] FIG. 11 is a top view of the magnet holding device shown in FIG. 9.
- [0022] FIG. 12 is a front view of the magnet holding device shown in FIG. 9.
- [0023] FIG. 13 is a cross-sectional view of the latching mechanism of the magnet holding device shown in FIG. 9 in its normal resting position.
- [0024] FIG. 14 is a cross-sectional view of the latching mechanism of the magnet holding device shown in FIG. 9 in its compressed position.
- [0025] FIG. 15 shows an alternate embodiment magnetic door latch mounted in a door and a doorframe.
- [0026] FIG. 16 shows an enlarged view of magnetic door latch in FIG. 15.
- [0027] FIG. 17 is a side view of the knob mounted recessed within a door.
- [0028] FIG. 18 is a side view of the knob mounted flush onto a door.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0029] A preferred embodiment of the present invention is now described with reference to the figures, where like reference numbers indicate identical or functionally similar elements. Also in the figures, the left most digit of each reference number corresponds to the figure in which the reference number is first used. While specific configurations and arrangements are discussed, it should be understood that this is done for illustrative purposes only. A person skilled in the relevant art will recognize that other configurations and arrangements can be used without departing from the spirit and scope of the invention.

[0030] Referring to FIG. 1, an embodiment of magnetic door stop 100 is shown. A first magnet 102 having a "positive" end 104 and a "negative" end 106 is mounted on outside surface 108 of door 110. A second magnet 112 having a "positive" end 114 and a "negative" end 116 is mounted on outside surface 118 of baseboard 120. Second magnet 112 may be mounted on other structures opposing door 110 such as wall 122. When door 110 is being opened and therefore moving towards wall 122, magnetic door stop 100 may be in repulsive configuration 124 to prevent door 110 from slamming into wall 122. Repulsive configuration 124 is accomplished when the like poles of first and second magnets are adjacent to one another and thus repel one another, i.e. "positive" end 104 of first magnet 102 will repel "positive" end 114 of second magnet 112 and "negative" end 106 of first magnet 102 will repel "negative" end 116 of second magnet 112. This may be accomplished in many possible configurations, including with the magnets aligned so that they make contact with one another upon the exertion of sufficient force, or with the magnets not actually making contact with one another but rather reaching sufficient proximity for the repulsive force to act in controlling or arresting the motion of the door. Repulsive configuration 124 results in preventing door 110 from slamming against wall 122.

[0031] As shown in FIG. 2, magnetic door stop 100 also can secure door 110 in an opened position by utilizing attractive configuration 226. Attractive

configuration 226 is accomplished when the opposite poles of first magnet 102 and second magnet 112 are adjacent to one another and thus attract one another, i.e. "positive" end 104 of first magnet 102 will attract "negative" end 116 of second magnet 112 and "negative" end 106 of first magnet 102 will attract "positive" end 114 of second magnet 112. Attractive configuration 226 results in door 110 being held in an open position.

[0032] As shown in FIG. 3, first magnet 102 may be located within door 110 such that the outside edge 301 of first magnet 102 is flush with outside surface 108 of door 110. Alternatively, first magnet 102 may be located on door 110 such that the inside edge 403 of first magnet 102 is flush with outside surface 108 of door 110 as shown in FIG. 4. The location of first magnet 102 and second magnet 112 is not limited to the bottom left corner of door 110 and the corresponding opposing position on baseboard 120, as shown in FIG. 1. Instead, first magnet 102 may be located anywhere on outside surface 108 of door 110 and second magnet 112 may be located in the corresponding opposing position on baseboard 120 or wall 122 such that when door 110 swings open, first magnet 102 and second magnet 112 are adjacent.

[0033] As shown in FIG. 5, second magnet 112 may be located within baseboard 120 such that the outside edge 501 of second magnet 112 is flush with outside surface 118 of baseboard 120. Alternatively, second magnet 112 may be located on baseboard 120 such that the inside edge 603 of second magnet 112 is flush with outside surface 118 of baseboard 120 as shown in FIG. 6.

[0034] FIG. 7 shows a magnet holder 728 that allows magnetic door stopper 100 to switch from repulsive configuration 124 and attractive configuration 226. Magnet holder 728 has a bottom 730 which can be mounted onto a door, baseboard, or wall with any appropriate holding mechanism such as a nail or screw. Two opposing sidewalls 732 and 734 project from bottom 730 of magnet holder 728. When mounting magnet holder 728, opposing sidewalls 732 and 734 should be parallel to the ground. Inserted magnet 736 can be inserted into the magnet holder 728 and may be either first magnet 102 or second magnet 112. If

the user wants repulsive configuration 124, inserted magnet 736 should be positioned so that the like poles of the magnets are adjacent to one another and thus repel one another. Alternatively, if the user wants attractive configuration 226, inserted magnet 736 should be positioned so that the opposite poles of the magnets are adjacent to one another and thus attract one another. The user can switch between the repulsive and attractive configurations by simply removing inserted magnet 736, flipping it 180 degrees, and then re-inserting magnet 736 into magnet holder 728.

[0035] FIG. 8 shows an alternate embodiment of magnet holder 728. In FIG. 8, magnet holder 828 is elongated and has bottom 830 and opposing sidewalls 832 and 834. Inserted magnet 836 can be inserted into the magnet holder 828 and may be either first magnet 102 or second magnet 112. Inserted magnet 836 has two portions, "positive" portion 838 and "negative" portion 840. Elongated magnet holder 828 has three portions, left portion 842, mid-portion 844 and right portion 846. The opposing magnet of magnet door stop will be lined up so that when door 110 closes, mid-portion 844 is adjacent to the magnet opposing inserted magnet 836. For example, if magnet holder 828 is mounted on a baseboard, the mid-portion 844 will be adjacent to magnet 112 on door 110.

[0036] If the user wants repulsive configuration 124, inserted magnet 836 should be positioned so that the like poles of the magnets are adjacent to one another and thus repel one another. For example, if magnet 112 on door 110 is mounted such that the "positive" end 114 is exposed, inserted magnet 836 should be aligned so that "positive" portion 838 is located over mid-portion 844 of magnet holder 828. Alternatively, if the user wants attractive configuration 226, inserted magnet 836 should be positioned so that the opposite poles of the magnets are adjacent to one another and thus attract one another. For example, if magnet 112 on door 110 is mounted such that the "positive" end 114 is exposed, inserted magnet 836 should be aligned so that "negative" portion 840 is located over mid-portion 844 of magnet holder 828. The user can switch between the repulsive and attractive configurations by simply shifting inserted magnet 836 so that the desired portion,

either "positive" portion 838 or "negative" portion 840 is located over mid-portion 844 of magnet holder 828.

[0037] FIGS. 9-14 show an alternate magnet holder 928 to allow a user to selectively choose between a repulsive configuration or an attractive configuration. FIG. 9 shows first magnet 102 mounted onto door 110. Magnet holder 928 is mounted onto wall 122 or baseboard 120, and second magnet 112 is mounted therein. Magnet holder 928 includes a plate 948 which is mounted onto outside surface 118 of baseboard 120 with screws 950 and 952. Two opposing sidewalls 954 and 956 extend from plate 948 and are spaced apart enough in order to allow second magnet 112 to be placed in between. Rod 958 is placed through sidewalls 954 and 956. Second magnet 112 will contain a hole (not shown) through it. Second magnet 112 will be placed between sidewalls 954 and 956 with rod 958 extending through the hole of second magnet 112. As shown in FIG. 10, second magnet 112 will freely rotate on rod 958 to enable user to select either positive end 114 or negative end 116 of second magnet 112 to face first magnet 102 mounted on door 110.

[0038] Magnet holder 928 also includes a latch mechanism 960 which permits easy rotation of second magnet 112, but also holds magnet 112 in place when user selects repulsive or attractive configuration of magnetic door stop. Shown on FIGS. 9-14 is one possible latch mechanism comprising of a spring-loaded ball 962. Spring-loaded ball 962 is attached to a spring 964, which is located within channel 966 of plate 948. Spring 964 attached to the bottom of channel 966. Channel 966 is located within plate 948 and is of substantial size for spring loaded ball 962 to fit therein. Spring-loaded ball 962 snaps into depression 968 on the end of second magnet 112 to hold second magnet 112 in place. Depression 962 will be located on both positive end 114 of second magnet 112 and negative end 116 of second magnet 112 to enable user to select between repulsive or attractive configuration of magnetic door stop.

[0039] FIG. 13 shows latch mechanism 960 is its normal position, with spring 964 at rest. In its normal position, at least a portion of spring loaded ball 962 is

located within channel 966 of plate 948. FIG. 14 shows latch mechanism 960 in its compressed position, with spring 964 compressed when spring loaded ball 962 snaps into depression 968 of second magnet 112. In its compressed position, spring loaded ball is pushed further down into channel 964 of plate 948.

[0040] First magnet 102 and second magnet 112 may be any appropriate magnetic material, including permanent magnets or electromagnets, and may vary in size. If magnetic door stop 100 is constructed with electromagnets, a user may select repulsive configuration 124 or attractive configuration 226 using a switch (not shown) that allows electric current to flow and consequently produces a magnetic field. In addition, magnetic door stop 100 may also be constructed by using a door of at least partially magnetic material instead of mounting first magnet 102 on door 110. With a door of at least partially magnetic material, second magnet 112 may be oriented in an attractive or repulsive configuration with the magnetic door.

[0041] FIGS. 15-18 show alternate embodiment of magnetic door stop 100. Referring to FIGS. 15-16, magnetic door latch 100a is shown. A first magnet 102a having a "positive" end 104a and a "negative" end 106a is mounted inside door 110a. A second magnet 112a having a "positive" end 114a and a "negative" end 116a is mounted inside doorframe 120a.

[0042] First magnet 102a and second magnet 104a may be in a repulsive configuration or a attractive configuration. Repulsive configuration is accomplished when the like poles of first and second magnets are adjacent to one another and thus repel one another, i.e. "positive" end 104a of first magnet 102a will repel "positive" end 114a of second magnet 112a and "negative" end 106a of first magnet 102a will repel "negative" end 116a of second magnet 112a. Attractive configuration is accomplished when the opposite poles of first magnet 102a and second magnet 112a are adjacent to one another and thus attract one another, i.e. "positive" end 104a of first magnet 102a will attract "negative" end 116a of second magnet 112a and "negative" end 106a of first magnet 102a will

attract "positive" end 114a of second magnet 112a. Attractive configuration results in door 110a being held in a closed position with doorframe 120a.

[0043] FIGS. 15-16 show a knob assembly 128a that allows magnetic door latch 100a to switch from attractive configuration to repulsive configuration. Knob assembly 128a contains knob 130a, which is attached to first magnet 102a. Knob assembly 128a also contains a suitable bearing or bushing to permit easy rotation of first magnet 102a. The suitable bearing or bushing also contains stopping means to align first magnet 102a with second magnet 112a of doorframe 120a. Knob 130a is rotated by user, which consequently rotates first magnet 102a to permit switch from attractive configuration to repulsive configuration. When switched to repulsive configuration, the magnets hinder the door's movement to the closed position, thus preventing or minimizing slamming. In addition, repulsive configuration may assist the user in opening door 110a if first and second magnets 102a and 112a are of substantial size. The size of first and second magnets 102a and 112a may vary depending on the needs of the user; i.e. a domestic user in a household doorway may only require a small magnetic latch 100a while a commercial user with a heavier door may require a larger magnetic latch 100a.

[0044] As shown in FIG. 17, knob 130a may be mounted recessed into door 110a. Alternatively, as in FIG. 18, knob 130a may be mounted flush onto outside surface of door 110a.

[0045] Alternately, second magnet 112a may be mounted within doorframe 120a such that user may switch second magnet 112a to be in a repulsive configuration with first magnet 102a or an attractive configuration with first magnet 102a. Second magnet 112a may be mounted in a channel of doorframe 120a such that user may simply pull second magnet 112a out of the channel, flip it around to the desired "positive" end 114a or "negative" end 116a, and insert back in the channel.

[0046] First magnet 102a and second magnet 112a may be any appropriate magnetic material, including permanent magnets or electromagnets, and may vary

in size. If magnetic door latch 100a is constructed with electromagnets, a user may select repulsive configuration or attractive configuration using a switch (not shown) that allows electric current to flow and consequently produces a magnetic field.

[0047] While this invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention.